U.S. Department of Energy - Energy Efficiency and Renewable Energy
Alternative Fuels Data Center

Benefits and Considerations of Electricity as a Vehicle Fuel

Hybrid and plug-in electric vehicles can help increase energy security, improve fuel economy, lower fuel costs, and reduce emissions.

Energy Security

In 2012, the United States imported about 40% of the petroleum it consumed, and transportation was responsible for nearly three-quarters of total U.S. petroleum consumption. With much of the world's petroleum reserves located in politically volatile countries, the United States is vulnerable to price spikes and supply disruptions.

Using hybrid and plug-in electric vehicles instead of conventional vehicles can help reduce U.S. reliance on imported petroleum and increase energy security. Hybrid electric vehicles (HEVs) typically use less fuel than similar conventional vehicles, because they employ electric-drive technologies to boost efficiency. Plug-in hybrid electric vehicles (PHEVs) and all-electric vehicles (EVs) are both capable of using off-board sources of electricity, and almost all U.S. electricity is produced from domestic coal, nuclear energy, natural gas, and renewable resources.

Fuel Economy

HEVs typically achieve better fuel economy and have lower fuel costs than similar conventional vehicles. For example, the 2012 Honda Civic Hybrid has an EPA combined city-and-highway fuel economy estimate of 44 miles per gallon, while the estimate for the conventional 2012 Civic (four cylinder, automatic) is 32 miles per gallon. However, some HEV models employ hybrid technology to boost power rather than efficiency and consequently do not have substantial fuel economy advantages over similar conventional vehicles. Use the Find A Car tool on FuelEconomy.gov to compare fuel economy ratings of individual hybrid and conventional models.

PHEVs and EVs can reduce fuel costs dramatically because of the low cost of electricity relative to conventional fuel. Because they rely in whole or part on electric power, their fuel economy is measured differently than in conventional vehicles. Miles per gallon of gasoline equivalent (mpge) and kilowatt-hours (kWh) per 100 miles are common metrics. Depending on how they're driven, today's light-duty EVs (or PHEVs in electric mode) can exceed 100 mpge and can achieve 30-40 kWh per 100 miles.

The fuel economy of medium- and heavy-duty PHEVs and EVs is highly dependent on the load carried and the duty cycle, but in the right applications, they can maintain a strong fuel-cost advantage over their conventional counterparts as well.

Infrastructure Availability

PHEVs and EVs have the benefit of flexible fueling: They can charge overnight at a residence (or a fleet facility), at a workplace, or at public charging stations. PHEVs have added flexibility, because they can also refuel with gasoline or diesel (or possibly other fuels in the future) when necessary. Both types of vehicles can take advantage of distributed sources of renewable energy, such as solar panels on a rooftop.

Public charging stations are not as ubiquitous as gas stations, but charging equipment manufacturers, automakers, utilities, Clean Cities coalitions, municipalities, and government agencies are establishing a rapidly expanding network of charging infrastructure. The number of publicly accessible charging units surpassed 7,000 in 2012. Search for electric charging stations near you.

Costs

Although fuel costs for hybrid and plug-in electric vehicles are generally lower than for similar conventional vehicles, purchase prices can be significantly higher. However, prices are likely to decrease as production volumes increase. And initial costs can be offset by fuel cost savings, a federal tax credit, and state incentives. The federal Qualified Plug-In Electric Drive Motor Vehicle Tax Credit is available for PHEV and EV purchases through 2014 (or until manufacturers meet certain thresholds of vehicle sales). It provides a tax credit of $2,500 to $7,500 for new purchases, with the amount determined by the size of the vehicle and capacity of its battery.

Use the Vehicle Cost Calculator to compare lifetime ownership costs of individual models of HEVs, PHEVs, EVs, and conventional vehicles.

Emissions

Hybrid and plug-in electric vehicles can have significant emissions benefits over conventional vehicles. HEV emissions benefits vary by vehicle model and type of hybrid power system. EVs produce zero tailpipe emissions, and PHEVs produce no tailpipe emissions when in all-electric mode.

The life cycle emissions of an EV or PHEV depend on the sources of electricity used to charge it, which vary by region. In geographic areas that use relatively low-polluting energy sources for electricity production, plug-in vehicles typically have a life cycle emissions advantage over similar conventional vehicles running on gasoline or diesel. In regions that depend heavily on conventional fossil fuels for electricity generation, PHEVs and EVs may not demonstrate a strong life cycle emissions benefit. Use the Vehicle Cost Calculator to compare life cycle emissions of individual vehicle models in a given location.

Batteries

Like the engines in conventional vehicles, the advanced batteries in plug-in electric vehicles are designed for extended life but will wear out eventually. Several manufacturers of plug-in vehicles are offering 8-year/100,000 mile battery warranties. Test and simulation results from the National Renewable Energy Laboratory indicate that today's batteries may last 12 to 15 years in moderate climates (eight to 12 years in extreme climates).

Check with your dealer for model-specific information about battery life and warranties. Although manufacturers have not published pricing for replacement batteries, some are offering extended warranty programs with monthly fees. If the batteries need to be replaced outside the warranty, it may be a significant expense. Battery prices are expected to decline as battery technologies improve and production volumes increase.